

## Broken structuralism

### Stathis Psillos

The ontic structuralist narrative has it that we can do away with “metaphysically robust or ‘thick’ objects” (64) and posit just relations and structures. In this essay, I will challenge some of the reasons that French adduces against ‘thick’ objects but I will mostly focus my attention on his conception of laws—which I think is problematic. My mode will be critical, but this does not detract from my admiration for French’s book.

**An epistemological haircut of objects.** The first of French’s gambits against a robust conception of objects is the so-called metaphysical underdetermination argument. In a nutshell, it is this: Given current physics, there are two competing “metaphysical ‘packages’”, one taking objects to be individuals, and another taking objects to be non-individuals. French is adamant that both conceptions are “compatible with quantum mechanics and can be considered ‘equally natural metaphysical doctrines’ in this context” (54). Why bother then? French finds it objectionable that current physics cannot settle this issue; that is, it cannot tell us “what the world is like when it comes to the most fundamental aspect of the nature of its objects— it simply cannot tell us whether they are individuals or not”. (37) Yet first, current physics will likely change in the centuries to come and future physics *might* be able to tell us. But, second, could physics *ever* settle the conditions of objecthood? These are metaphysical (or framework) conditions, and are presupposed by physical theories rather than licensed by them.

What is the radical change that QM has brought to our thinking about this metaphysical issue? Presumably, that we are free to choose between two competing conceptions of objecthood—both compatible with QM. But if we treat the conditions of objecthood as a broadly empirical issue, why is the case any different from any ordinary case of underdetermination of theories by evidence? If for instance we have to choose between the GRW interpretation of QM and Bohm’s interpretation, we are not thereby led to the conclusion (at least without further ado) that there is no fact of the matter as to which is the correct description of the world. Nor do we jettison the concept of a be-able, though we may disagree as to whether they are particles or flashes. Rather we hope we may get more and fresh evidence that will possibly settle the issue. Why can’t we say *exactly* the same vis-à-vis the objects-as-individuals and the objects-as-non-individuals conceptions of objecthood? In fact, if we are to take seriously French’s thought that objects-as-non-individuals is currently a live option (while it was *not*, say, a century ago), we should leave it open that broadly empirical and theoretical considerations might be able to turn the balance in its favour (or in favour of its competitor).

French’s considered view is that the best way forward is to break the underdetermination deadlock by eliminating objects altogether (63). Isn’t this so *obviously* premature? Would it not, back in time, counsel scientists to eliminate gravitational forces altogether given that they could have a conception of them as action-by-contact and one as action-at-a-distance? This is not a rhetorical

question: it is meant to motivate the claim that epistemological considerations should not carry too much metaphysical weight. That we do not know whether X is Y or not Y is not reason, in and of itself, to deny X.

The second argument for eliminating object is that positing metaphysically robust objects is conducive to epistemic *humility*; for it is left entirely open that we may not know what these objects are *even if* we know a lot as to how they relate to each other. French says: "Here we have way too much humility! Indeed, it is surprising that the object-oriented realist has got away with such a high level of humility for so long but perhaps this is simply because the metaphysics behind her realism is typically not examined very closely, which in turn has to do with the continued failure to fully engage with the implications of quantum mechanics" (61). Is the point then that QM implies much less humility? I doubt this since QM is consistent with object-oriented realism. What at best follows is that QM *in conjunction with* French's claim of eliminating objects entails less humility (that is more epistemic audacity). But this is hugely question-begging. For even though knowing X & Y is less humble than knowing Y, it is *not* less humble than knowing X & (not-Y)! For (not-Y) must be known too and all we have with OS is the conditional claim: *if* we assume X & not-Y (viz., there are no objects), *then* we know no less (*but I doubt we know more*) than if we assume X & Y (viz., there are objects).

Humility is simply not the right reason to prune the metaphysical pantheon, as French puts it, unless there are independent (metaphysical) reasons to remove some of the metaphysical gods and goddesses.

To pursue some of the implications of French's epistemological haircut of metaphysics it would be necessary to discuss Cassirer's relationism. Indeed, Cassirer is OS's precursor—at least motivationally. But lack of space does not allow me to do this now. Instead, I will just state that Cassirer's relationism was neo-idealist—according to which the object "is drawn into the process of knowledge"—being mitigated only by the fact that the relations that constitute the object are potentially inexhaustible and hence the epistemologised concept of an object becomes a limit concept which is cognitively approached by never reached.

**Does OS avoid neo-idealism?** The ontology-in-the-service-of-epistemology gambit is central for French too since his key motivations for eliminating objects are epistemological arguments: underdetermination and anti-humility. *Prima facie*, French gives an ontological twist to Cassirer's relationism: he renders relations from a condition of knowledge to elements of ontology. He is adamant that in borrowing elements from Cassirer, he resituates objectivity "in the laws and principles of our best theories", and takes them to represent "features of a mind-independent reality" (99-100). But in spelling out the details of his views about laws and principles of our best physical theories, he comes, I think, perilously close to compromising realism. Let us see why this is so.

On the face of it, French's OS is realist. French insists that "the structure of the world should not be identified with its mode of presentation" (11). The mode of presentation of the structure of the world is the way this structure is given to us by a certain theory or theories. French contrasts the mode of presentation with the mode of representation of structure, which he associates with typical philosophical reconstructions of structure in terms of set-theory and the like. For

him the structure of the world is presented by group theory—the structure of the world thus *presented* is group-theoretic. He notes: “at the level of scientific practice, group theory was introduced and used to represent physical objects, their properties, and the latter’s relevant interrelationships. This is the mode by which these objects are presented at this level” (137).

Now, I see no way for OS to identify the structure of the world independently of the way it is presented by the theory—even in principle. Hence, I see no way for OS to argue that the structure of the world—as this is *independently* of how it is presented to us via group-theory—can act (even in principle) as an external constraint on our theorizing about the world. To put the point differently, if the structure of the world is presented to us via group theory, what is it for the theory *not* to get the structure of the world *right*? It seems the theory has to get the structure of the world right since there is no possibility of divergence between the group-theoretic presentation of the structure of the world and the way the structure of the world *really* is. As I have repeatedly argued, blocking off this possibility of divergence between what the world is like and what it is presented to be like by even our best scientific theories is the trade-mark of modern (verificationist) anti-realism; and it is there to secure the in-principle knowability of the world. I would then urge the advocates of OS to tell us how the structure of the world might be different from the group-theoretic structure of (even the best) theory. To be a bit provocative, the only way I can see this happening is by admitting that OS itself is wrong—that is by admitting as a possibility what OS denies, viz., that the world is characterized by a structure of objects and properties and relations which the theory does not get right.

French warns us against sliding into ‘naïve’ Platonism by being tempted to say “that the world is group-theoretic”. He adds “the group theory itself represents that feature of the structure of the world and it is in such terms that these features are presented to us in the appropriate theoretical context” (137). All the more so! If the structure of the world is not necessarily group-theoretic but it is presented thus, what, in principle, *is* the structure of the world in way that could be spelled out independently of group-theory? Unless an answer to this question is canvassed, I see no way for OS to avoid an anti-realist conflation between the structure of the world and its theoretical (even the best theoretical) presentation of it.

To pursue this point a bit further, let us see how committed French seems to be to the view that the structure of the world *is* group-theoretic. In arguing that a motivation for OS is “precisely the lack of independent existence of the relevant entities and kinds” in the sense that they simply fall out of the relevant symmetries (the Permutation Invariance symmetry in the case of bosons and fermions), French goes as far as to claim that we cannot have the fundamental properties (spin, charge, mass) *unless* we have the relevant symmetries, as these are characterized by the relevant group-theoretic structures (289). It is clearly one thing to say that these properties are “metaphysically dependent on (...) the structure of the world” (289); but it is quite another thing to identify this structure with its group-theoretic presentation. And without the latter, it simply does not follow that we cannot have the fundamental properties without the relevant group-theoretic structures.

**What is structure?** A lot depends, naturally, on how we understand *structure*. To his credit, French answers this question directly: “‘what is structure?’ It is the laws and symmetries of our theories of contemporary physics, appropriately metaphysically understood via notions of dependence and taken as appropriately modally informed”.

Now this characterization of structure shifts the question to laws and symmetries ‘metaphysically understood’. It’s hard to comprehend symmetries without the notion of invariance under a group of transformations and hence it’s even harder to understand them ‘metaphysically’—that is independently of their group-theoretical expressions. After all, as French notes, “laws plus the kinds of symmetries that group theory so beautifully captures make up what the advocate of OSR insists is ‘the structure of the world’ (142). Later on, however, French adds another element to the structure of the world: *initial conditions*. On p.286, he adds “specific values of certain properties, such as the mass of quarks or the charge on the electron. These can be thought of as akin to initial conditions that specify the nature of this world as contrasted with other possible worlds in which the relevant laws (...) hold”. So the structure of the world has an irreducible element: the specific values of specific properties—what French likens to initial conditions. Without this element nothing can get going, as it were. The laws are impotent to account for any action in the world, unless specific properties get specific values. As French acknowledges, these features of the structure of the world (those assigned to initial conditions) “cannot be obtained from those symmetries and associated laws” (194). *Ergo*: no matter what you call it, there are non-structural elements to the structure of the world (understood as laws and symmetries).

French states boldly: “according to OSR (...) symmetries are a fundamental feature of the structure of the world” (17). But what symmetries really are is a rather controversial issue (though no-one denies their importance). The key problem is whether they should be understood as features of the world or as expressions of our ignorance of the laws that govern the world (or (perhaps) as transcendental principles that put constraints on the knowledge of the world). Eugene Wigner, famously, took it that symmetries do not add “new information” about the world which is not already offered by the laws of nature. As he (1964, 958) put it: “if we knew all the laws of nature, or the ultimate law of nature, the invariance properties of these laws would not furnish us new information”. But this does not imply that symmetries are nothing—rather, they provide “a structure or coherence to the laws of nature”. This is seen very clearly if we think of the global spacetime symmetries which, through the requirement that the laws must remain invariant under certain transformations, constrain all laws of nature and entail the existence of conserved quantities (like energy and angular momentum). On this view, symmetries may be seen as constraints on laws, or as a kind of meta-laws which there are in the world *insofar as there are laws in it*. As French (151) admits, on this view, symmetries are not substantive metaphysical additions to the world and are fully consistent with viewing laws as grand-scale regularities.

Unsurprisingly, French chooses a Cassirerian line on symmetries—by equating (in a contentious manner, I think) Cassirer’s ‘principles’ with symmetries: for Cassirer, principles were epistemological principles making scientific knowledge possible, whereas for French symmetries are taken to be

generating the structure of the world. Be that as it may, French sums up his view as follows:

law statements express the network of relations, 'held together' by the symmetry principles which represent what is invariant in the network. How this holding together is effected obviously depends on how one conceives of the relationship between laws and symmetries. It might seem that views according to which symmetry principles act as constraints on laws, or, at least in some cases, directly yield laws, are more amenable to this idea of holding together than the view which holds that symmetries are merely 'by-products' of laws. However, even in the latter case, one might argue that symmetries can fulfill the same role even as by-products, or more precisely, higher-order features of laws, since, as such, they are able to span, as it were, the laws and thus function to 'tie' the structure together. Attempts to adjudicate between these views typically involve appeal to features of scientific practice which are not, in fact, decisive. Given this, (...), I shall continue to maintain the Cassirerian line that there is a kind of 'reciprocal interweaving and bonding' between laws and symmetries and that it is this that yields those entities formerly known as objects (264).

The key statement in the passage above is the first: *law statements express networks of relations*; and the key question is: *what are these relations and what exactly do they relate?* We will discuss this issue in the sequel. For the time being, let me focus on the alternative view of symmetry as by-product of laws. This is associated with the existence of the so-called dynamical symmetries—such as the Permutation Invariance symmetry—which are related to specific features of the micro-world and refer to specific interactions. Dynamical principles do not place constraint on laws. Rather, they follow from certain laws (that is, interactions). It is then hard to see how symmetries can be metaphysically substantive parts of the structure of the world. The symmetries-as-by-products do not 'tie' the structure of the world together unless it is already 'tied' together by dynamical laws. Besides, as French admits (237), the view that symmetries are by-products of laws is fully consistent with viewing laws as grand-scale regularities.

Whichever way you look at it, then, (symmetries as constraints or symmetries as by-products) symmetries do not force on us a non-Humean account of laws. Besides, laws seem to have ontic priority over symmetries: *no laws in, no symmetries out*. Symmetries are not a substantive metaphysical add-on.

**What are the laws of nature?** It all comes down to laws, then. One would have expected a rather full-blown structuralist account of laws. But, by and large, we get only a rough sketch. To be sure, French wants to avoid both a Humean regularity view of laws and a dispositional essentialist account of them. His starting point is Mumford's dilemma. According to Stephen Mumford (2004), the world is lawless: there are no laws, though there are modally laden properties. Part of the reason for this is that there is nothing for the laws to do—in particular, laws cannot govern their instances. If laws codify external relations to the properties involved in them, they are substantive additions to the world, but they cannot govern their instances; if they codify internal relations among properties, they are no substantive additions to the world and there is nothing for them to govern. I have criticized Mumford's views in my (2006a). The heart of the problem is the relation between laws and properties: we all agree they tend to go together, but the issue is where the action lies. For the Humean,

properties are, by and large, passive; so the action is with the laws. For the anti-Humean (*aka* dispositionalist), properties are active potencies, so either laws sum up the patterns of action among properties (Alexander Bird, Brian Ellis) or are (because they do) nothing (Mumford). French intends to avoid this dilemma by redrawing the relation between laws and properties. As he puts it, adopting the structuralist perspective on laws “sets [laws] as primary and the relevant properties as emergent” (257).

Here comes the tricky bit:

if what makes a causal property the property that it is, are the relations that it enters into with other such properties, with the conjunction of the laws comprised by these relations specifying the natures of all the causal properties there are, then reading this identity chain from right to left, as it were, and ontologically, we can take the laws (understood structurally of course) as fundamental and the powers and properties as emergent from the relevant relations, with no need for dispositions (257).

This ‘right to left and ontological reading’ French calls ‘reverse engineering’. The idea is reversing the dispositionalist relation between properties and laws. While the dispositionalist takes properties as primary and laws as emergent and totally dependent on the relations among properties, the structuralist takes laws as primary and recovers properties from the *relations* embodied in the laws. At least that’s how I read the right-left direction in the complex passage just quoted.

That my reading is natural—that is, that laws embody *relations*—is supported by what was noted above, viz., that for French laws express networks of relations. But this move shifts the focus (once more) from laws to relations: what are they and how are they embodied/expressed in laws? This is *the* critical question. Unless it is answered, we have no structuralist theory of laws, and given the centrality of laws for structure, no structuralist theory of structure!

Apropos, I totally agree with French on his critique of dispositionalism. Actually, as I have argued elsewhere (2006b), symmetries are important precisely because they allow us to introduce properties in neo-categorical terms and *not* by means of their effects. But French wants to move one step further and, for all practical purposes, to denigrate properties. Properties depend upon laws, we are told (264 & 302).

Note that French disfavours the metaphor that laws ‘govern’ their instances. What exactly, then, is the relation of metaphysical dependence that he favours? (By the way, metaphysical dependence is a *relation*—but what are its relata?) It is said to be the relation between determinable and determinates: “(...) the nature of the dependence between the structure and kinds, properties, and putative ‘objects’ (e.g. elementary particles) is shaped, or fleshed out, by the relationship between determinables and determinates” (290).

The motivation for this view is the thought that laws of nature relate properties (eg. Mass) *qua* determinables, that is *qua* admitting determinate property-instances (i.e., values of quantities). But French pushes this line one step further by claiming that laws themselves are “relation-determinables” (283) and as such they yield “determinate instances of these properties”. Here is his example: “(...) Coulomb’s Law as a relation-determinable both has determinate instances and yields charge as a property-determinable, which has determinate instances such as *e*, the charge of the electron” (283). But what *is* a relation-determinable? I can fully understand that we might see Coulomb’s law and

Newton's law of gravity as determinate relations of a 'relation-determinable', the latter being the common algebraic expression of the two laws as functions of the inverse-square of the distance. I can also understand Coulomb's law as a determinate with  $n=2$  of a determinable relation between force and distance, where force varies inversely as the  $n$ -th power of the distance. I can also understand 'being taller than' as determinable of 'being taller by an inch than'.

It is there where my understanding of relation-determinables ends. And none of the above seems to be what French has in mind when he talks about relation-determinables. Coulomb's law is *at best* a second-order universal, which captures relations between first-order universals such as charge, distance and force. And the latter are determinable quantities insofar as they are first-order universals which have particular values instantiated by particular instances/particulars as determinates. But a) there is nothing particularly structuralist about this view; and b) the law does not determine (yield) the properties; it simply relates them.

Since French follows Ingvar Johansson in talking about relation-determinables, let us take his exemplar of a relation-determinable, which is the following sequence (from the more determinate to the determinable): being a little longer than—being longer than in general—length relation—relation. It is still unclear to me how we can use *this* model to understand Coulomb's law as relation-determinable. Now, French might simply mean that the determinate relations corresponding to Coulomb's law (as a relation-determinable) are the relations we get between particular charges, particular distances and particular forces. That is, the relations we get when we plug in certain *values* to charges and distances. So a determinate relation would be a relation between, say, two electrons  $e_1$  and  $e_2$  at a certain distance—say  $d$ —from each other. Now if *these* are the determinate relations of Coulomb's law, then they are relations ordinarily understood as involving relata with specific spatio-temporal locations. More importantly, however, these cannot be taken to be determinates of a determinable. Determinates (of the same level) satisfy—constitutively—the *exclusion* principle: a determinate  $X$  of a determinable  $Y$  excludes all other determinates of  $Y$ . For instance, being scarlet (as a determinate of red) excludes being crimson. But being an instance of Coulomb's law does not exclude being another instance of the law. On the contrary, the state-of-affairs of two electrons with charge  $e$  being at distance  $d$  from each other does not exclude that *these very same electrons* being at different distances. If Coulomb's law is indeed a law, then it entails its instances, which are then compatible with each other. I conclude that the idea of laws as relation-determinables fails.

If instead of an array of 'determinate relations', we simply get instances of the law, then what we are left with is laws as relations among properties and properties being instantiated by particulars. We can no longer think of the relation between laws and properties as the relation colour has to red or shape to triangular. Rather, we have to face the issue of what properties are and how they are related to each other in lawful patterns. Humeanism or dispositionalism become the players again.

However, French insists that there cannot just be an ontology of determinables; determinates are also required. This is because determinables are too general and, ultimately, abstract. He therefore takes the "whole package of determinables and determinates as what we mean by 'the structure of the

world” (287) and “to cash out that definite article [*the* structure of the world] we have no option but to bring in specific, determinate elements”. But what are they? They are property instances. Having noted that symmetries yield properties, French adds: “And with the laws encapsulating the relations between tokens of these properties we have the kind of dependence of the latter on structure that I discussed previously” (265). What’s striking here is the reference to *tokens* of properties. It is relations between *them* that are ‘encapsulated’ by laws. For one, laws relate properties. For another, laws relate *tokens* of properties, that is instantiated properties, eg. the mass of an electron or the mass of any two bodies in the universe, or spin-1/2 of an electron. But what are these properties instantiated into if not objects? It’s, of course, little consolation to the structuralist to say that property instances are tropes. Either way, it is a victory of particularity.

For French relations are the building blocks of laws of nature which are the building blocks of the structure of the world. I have argued that French’s structuralist conception of laws as relation-determinables is wrong-headed. Be that as it may, we have no account of how laws qua relational states in the world yield any regularities. For instance, what exactly is that which enforces the relation encapsulated in Coulomb’s law between *universals* (determinables in French’s account) Force, Charge and Distance to be instantiated in the world in a lawful pattern? In other words, to use familiar terminology, what if anything necessitates the properties involved in the law to be co-instantiated?

It’s not enough to say that for the structuralist “these relations [will] always [be] there, in the world, as it were, or always and continually ‘manifested’, to adopt dispositional language” (255). For, as French admits, laws relate determinable quantities and what there is in the world are specific instances (values) of these quantities. Hence, it is still an issue how the *specific* quantities that there are in the world are related to each other in such a way that they fall under the law that relates determinable quantities.

The chief argument, then, for positing objects is that laws of nature are patterns in the behaviour of objects in the world. Even if we were to accept the OS view that laws are prior and that “properties and hence putative ‘objects’ are dependent upon laws” (288), objects would be required for laws to be instantiated into and hence for the them to have any concrete and worldly content. (By the way, I doubt that the view that laws are relation-determinables can explain the difference between instantiated and uninstantiated laws except by brute force: some relation-determinables have instances while other not.)

Object-in-relation—as an ontic category of being for OS—should be supplemented by ‘being in relation’ as a way to understand what it is to be related. We all know centrality of relations for OSR, but we have seen no theory of relations. Relations relate—relations express facts of *relatedness*. But then the question invites itself: what are those that are related by a relation? If *this* question is eschewed on the grounds that relations do not, necessarily, relate, then it is no longer clear why they are *relations*. So we must identify that which is related—and we should also understand what it means to say that whatever is related comes to be in a relation. I think this issue is conceptually prior to the issue of whether the relata are thin objects or thick ones. OS has yet to deal with it.



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